LM 28 & 29.

HW 8 #34 withdrawn.
Will be in HW 9.

3/26/13

Quiz

Hydrogen 3 (tritium H-3) is sometime. formed in the primary coolant water of a nuclear reactor. Tritium is a beta emitter (assume electron) w/ $t_{1/2}$ = 12.3 yrs For a given sample containing tritium after how many years will only about 12% of sample.

100 → 50 → 25 → 12.5

3 x half life.

$\frac{\ln(2)}{K}$ = Half life

$\ln\left(\frac{N}{N_0}\right) = -kt$

N = how much you have left.

N0 = how much you started with.

$$\frac{\ln(2)}{12.3} = \frac{12.3\,K}{12.3}$$

$$\frac{\ln\left(\frac{.12}{1}\right)}{-K} = \frac{-Kt}{-K} \qquad \boxed{t = 37}$$

rxn rate - normalize it → per mole.

$$2NO_2(g) \rightarrow 2NO(g) + O_2(g)$$

rxn rate $= -\frac{1}{2}\frac{\Delta NO_2}{\Delta t} = \frac{1}{2}\frac{\Delta[NO]}{\Delta t} = \frac{\Delta[O_2]}{\Delta t}$

(because 2 NO_2 goes on)

2 mol NO_2 = 1 mol rxn.

1 mol O_2 = 1 mol rxn.

divide by Molar coefficient to normalize rates.

Δ = final - initial.

Avg Rate $\frac{[NO_2]_f - [NO_2]_i}{t_f - t_i} = \frac{\Delta[NO_2]}{\Delta t}$

Instaneous rate is slope of tangent line.

take derivative $-\frac{d[NO_2]}{dt}$.

Intial reaction rate - is the at $t = 0$. Best to define. determined by finding instantaneous rate @ $t = 0$.

$CH_3 + OH^- \longrightarrow CH_3OH + Cl^-$

Macroscopic

$$\frac{-\Delta[CH_3Cl]}{\Delta t} = \frac{-d[CH_3Cl]}{dt} = \text{rate} = K[CH_3Cl]^1[OH^-]^1$$

1st order in CH_3Cl

1st order in OH^-

Overall order = 2nd Order rate kentics.

X radioactive decay is always 1st order.

ex $(CH_3)_3CBr + OH^- \rightarrow (CH_3)_3COH + Br^-$

$$\frac{-\Delta[(CH_3)_3CBr]}{\Delta t} = \frac{-d[(CH_3)_3CBr]}{dt}$$

you need data to get 1st order or 2nd order.

Exp.					
1	2x ↓	0.1M	0.1M	2x ↓	2.5×10^{-3}
2		0.2M	0.1M	2x ↓	5.0×10^{-3}
3		0.1M	0.2M		2.5×10^{-3} ↓

Nothing changes.

→ What is rate law for this reaction.

rate doesn't depend on OH^-

rate law tells me from data that 1st order for $(CH_3)_3CBr$ & 0 order for OH^-

$\boxed{K[(CH_3)_3CBr]}$

ex. $A + 2B \rightarrow C$

The reaction is what order in (B)

exp.	A	B	initial rate
1	0.1 M	0.1 M	2.73
2	0.15 M	0.1 M	6.14
3	0.1 M	0.2 M	2.74

A 0

looked at data from exp. 1 & 3, B concentration is change but rate is similar to 2.73.

ex. The reaction is what order in A?

$$\frac{6.14}{2.73} = \frac{K[.15]^x [.1]^y}{K[.1]^x [.1]^y}$$

$$2.24 = \left(\frac{0.15}{0.1}\right)^x \left(\frac{.1}{.1}\right)^y$$

$$2.245 = 1.5^x$$

$$\ln 2.245 = x \ln 1.5$$

$x = 2$

$$2.73 = K[A]^2[B]^0$$

$$K[0.1]^2$$

$$2.73 = K(.01)$$

$$= 273 \ M^{-1}s^{-1}$$

units for $K = M^{-1}s^{-1}$

Ex. $CO + H_2O \quad CO + H_2$

is rate = $K[CO]^1[H_2O]^1$

Second order rate.

1st order in CO & 1st in H_2O.